Model Application for Monitoring Contaminants in Fish:
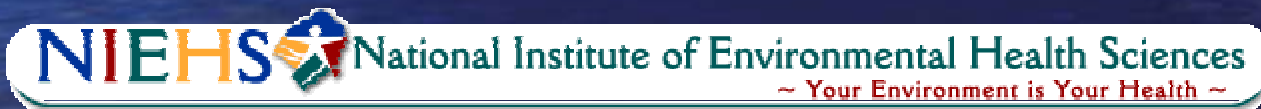
Mercury Pilot Project

Paul Hearn   Stephen Wente   John Aguinaldo   David Donato

Susan Price   Seth Tanner   Ovidio Rivero-Bartolomei

USGS science for a changing world

NIEHS National Institute of Environmental Health Sciences
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Samples Difficult to Compare

Species	Sampling Events						
	1	2	3	4	5	6	7
A	X	X		X			X
B		X	X		X		X
C	X		X	X		X	
D		X		X		X	
E	X		X			X	

Fish Hg Model Details

- Regression method (Covariance model)
- Accounts for:
  - Less than detection limit values
  - Differences between samples
    - Species (Hg increases with trophic position)
    - Tissues sampled (skin-off fillet > skin-on > whole)
    - Fish length (larger fish are higher in Hg)
- Calibrated to national dataset (35,130)

Fish Hg Model (log-log space)

- **Slopes** – describe potential Hg accumulation rate for each sample type

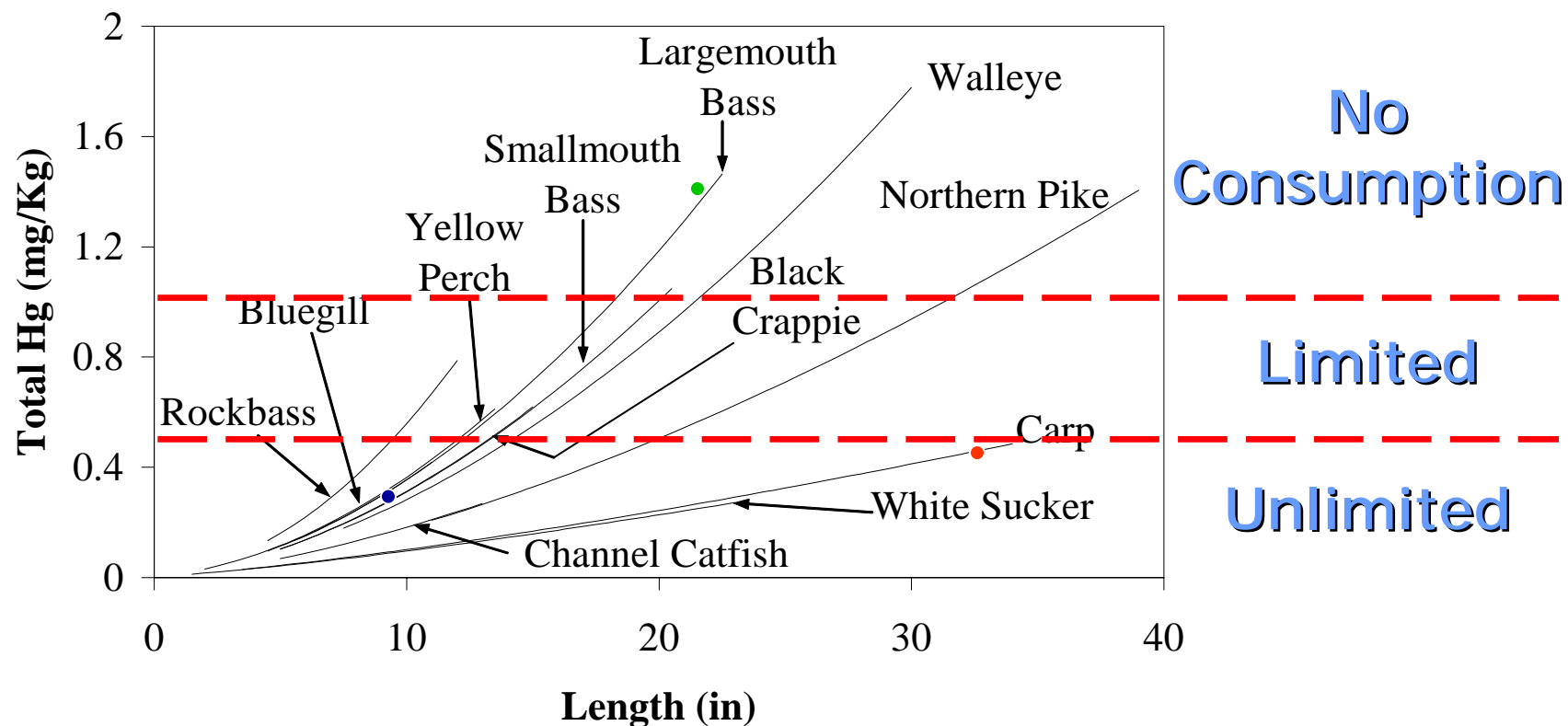- **Intercepts** – describe levels of bio-available Hg "before" each sampling event
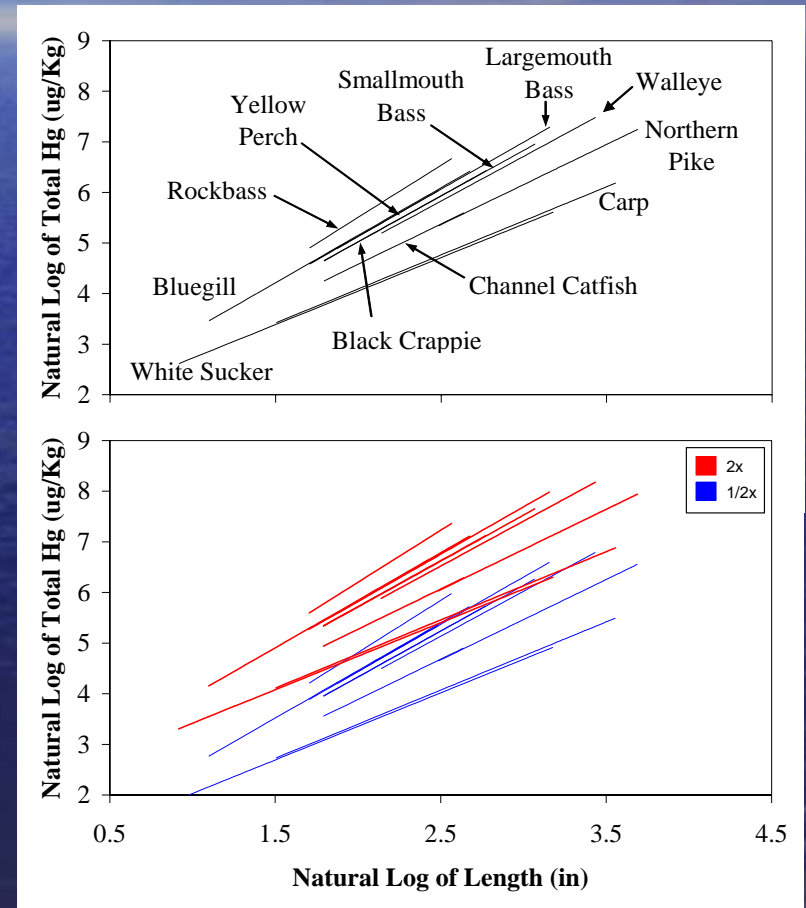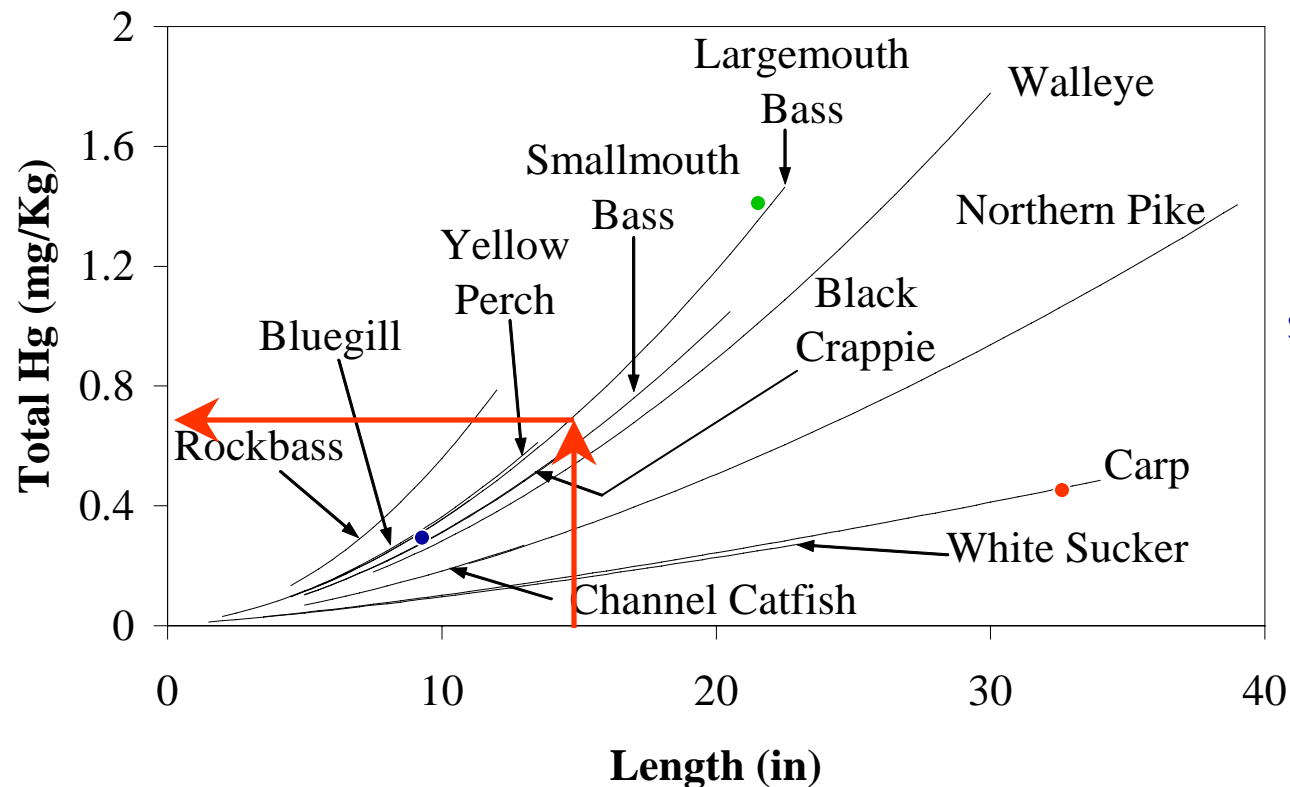
Fish Hg Model (arithmetic space)

- **Slopes** – become exponents describing curvature

- **Intercepts** – become multiplication factors

- **Error** – has a log-normal distribution
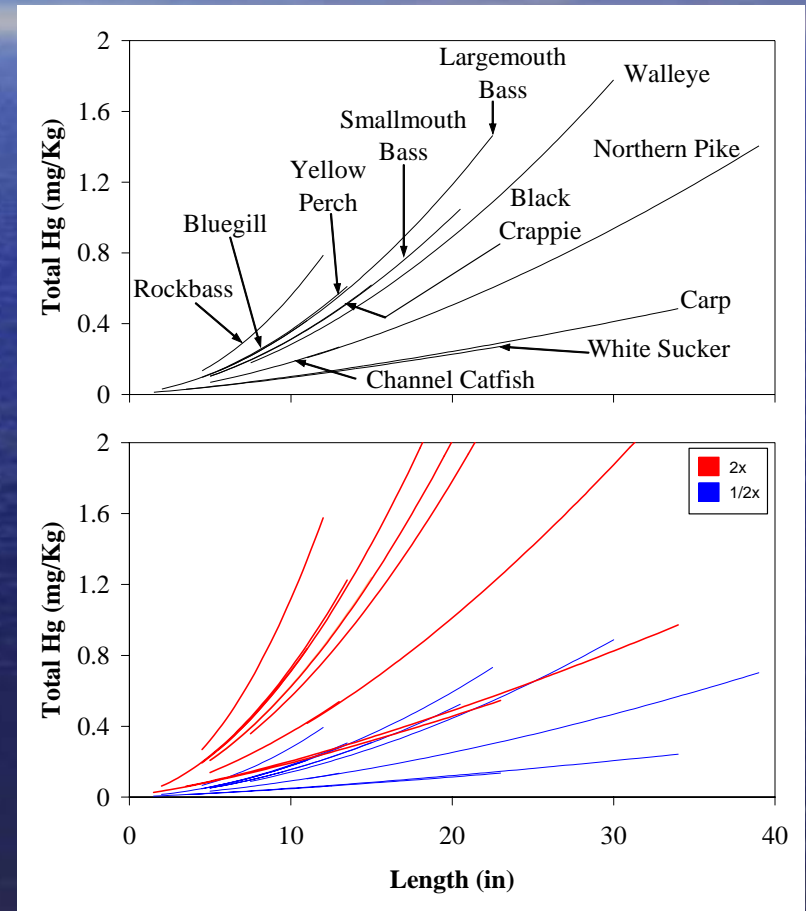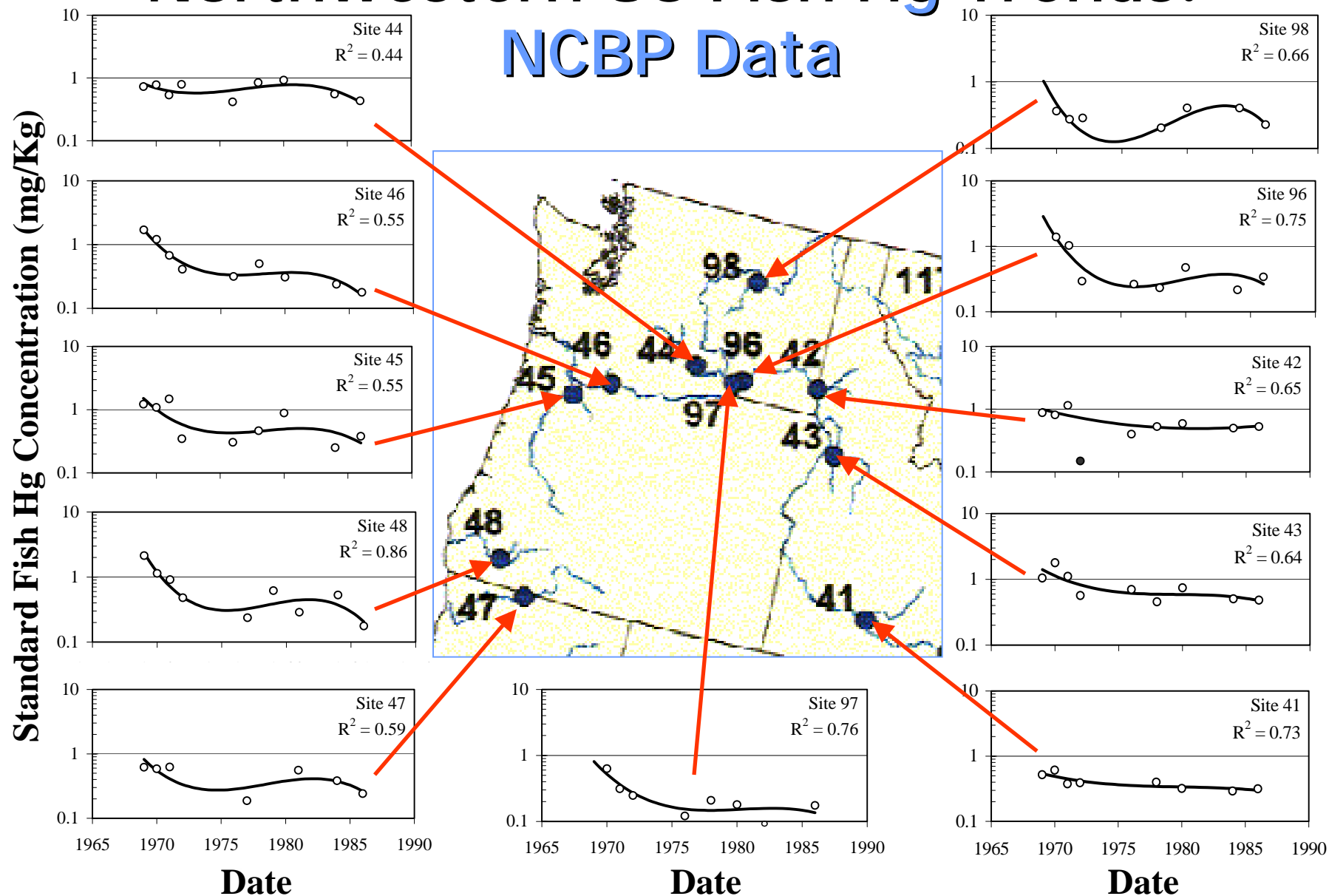
Consumption Advisory
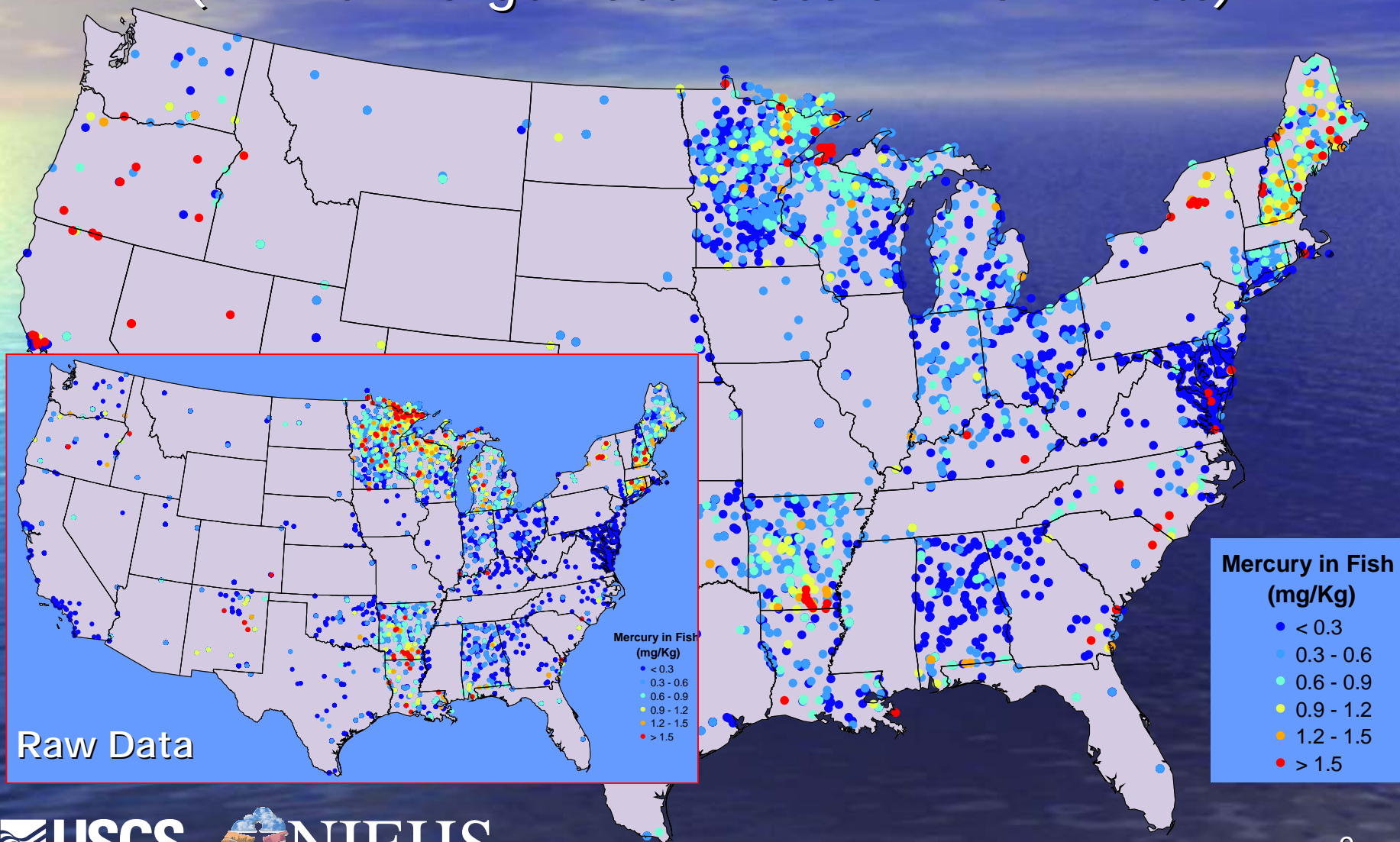
Standardize Sample Type

Northwestern US Fish Hg Trends: NCBP Data

Standard Fish Hg Concentration (mg/Kg)

Site 44, $R^2 = 0.44$

Site 46, $R^2 = 0.55$

Site 45, $R^2 = 0.55$

Site 48, $R^2 = 0.86$

Site 47, $R^2 = 0.59$

Site 98, $R^2 = 0.66$

Site 96, $R^2 = 0.75$

Site 42, $R^2 = 0.65$

Site 43, $R^2 = 0.64$

Site 41, $R^2 = 0.73$

Site 97, $R^2 = 0.76$

Date

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Modeled Spatial Variation
(14 inch Largemouth Bass Skin-off Fillets)

Raw Data

Mercury in Fish (mg/Kg)
- < 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
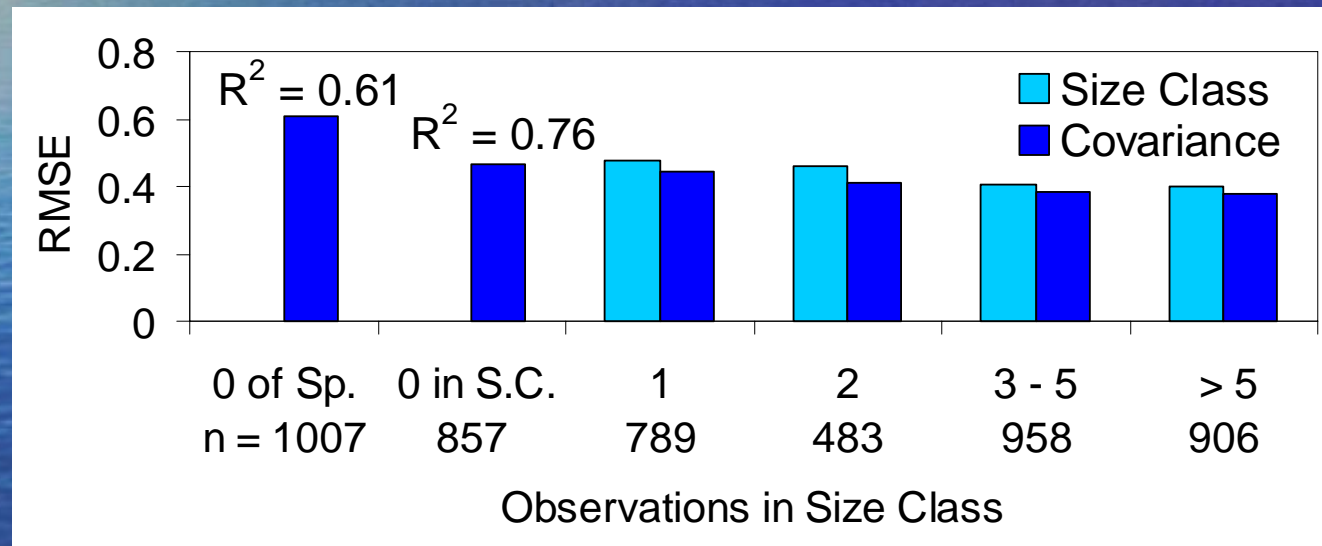- 1.2 - 1.5
- > 1.5

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Modeled Data Can Show Spatial Trends Not Reflected in Raw Data
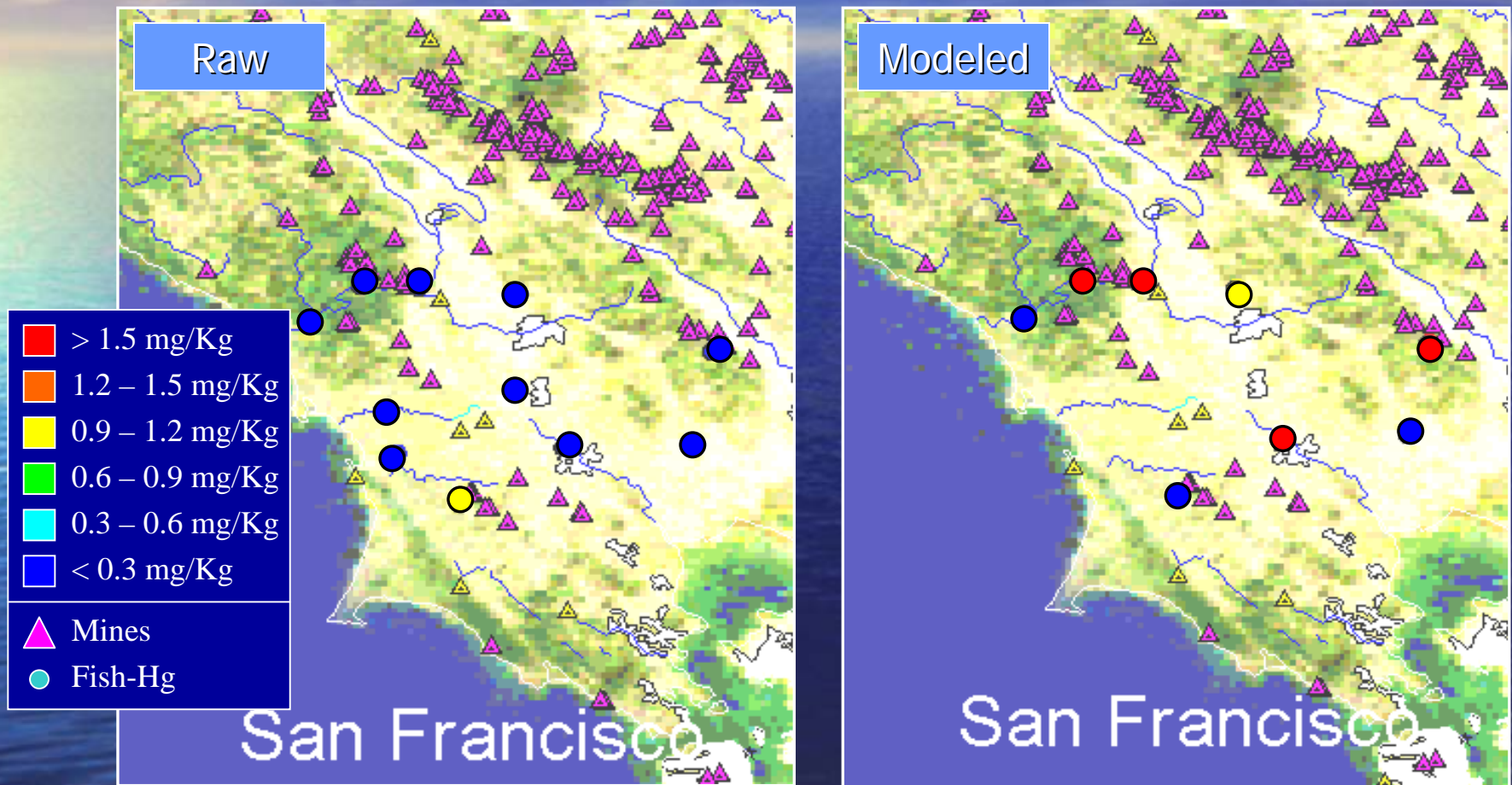
Accuracy Assessment

- Calibrated to NLFWA data (n = 31,813)
- 5000 random jackknife predictions

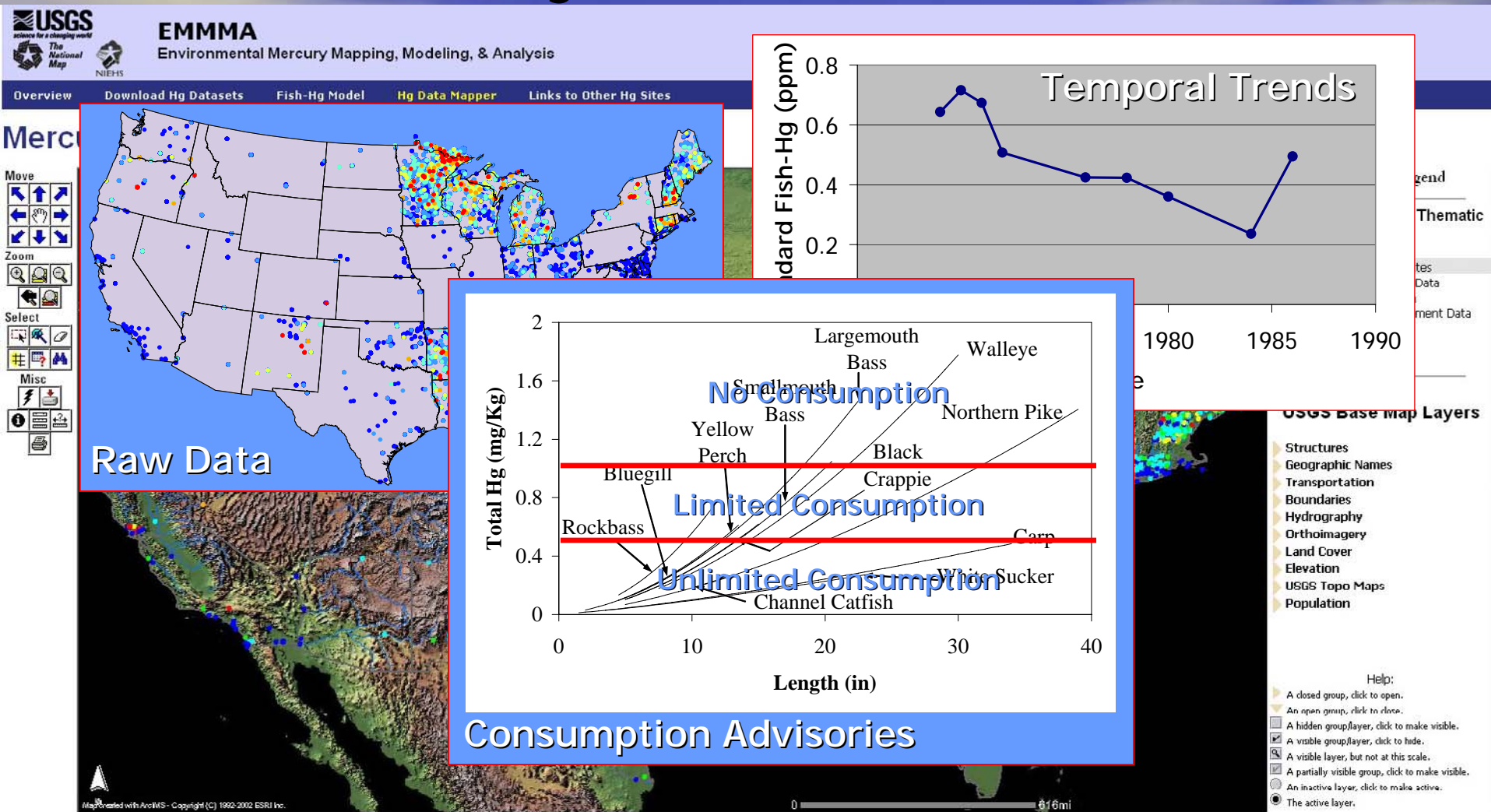Information quality & quantity is better

Analytical Cost Reduction

Species	5
Size classes	3
Sites	50
Times	5
Replicates	4
Cost/Sample	$100
Size classes	$1,500,000
Covariance	$100,000

*Sample types is number of species × size classes × tissue types

Project Website

"Continuously updated" data & analysis

How Can I Evaluate this Model?

- You <u>voluntarily</u> provide data

- ~~You apply model~~ We apply model and provide results on website

- You evaluate prediction quality (Do predictions make sense?)

- You decide if, and how much, results are used

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Questions/Comments

Additional information:

- Website demonstration in poster area (sign-up to receive website address)

- Peer-reviewed publication in preparation

- Request presentation (via telephone) to your group (spwente@usgs.gov)

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